We claim:

SUB A1

1. In a video coder for coding video images in a block format, a method for improving compression of the video images comprising:

predicting x and y motion vector components for a current block of pixels based on a motion vector of at least one neighboring block of pixels to compute x and y components of a predictor motion vector;

computing differential x and y components from the x and y components of the predictor and x and y components of a motion vector for the current block; and

assigning a single variable length code to joint x and y differential motion vector components, such that shorter variable length codes are assigned to joint differential motion vector components that have a higher probability of occurrence in the video images, and longer variable length codes are assigned to joint differential motion vector components that have a lower probability of occurrence.

2. The method of claim 1 wherein the variable length codes are assigned from a variable length code table comprising a list of pairs of joint differential motion vector components and a corresponding variable length code for each pair of joint differential motion vector components.

SUB A2

3. The method of claim 2 wherein the assigning step includes:

looking up the joint differential motion vector components in the table;

when no match is found in the table, coding an escape code along with a fixed length code for each differential motion vector component.

4. The method of claim 1 wherein the block of pixels corresponds to a macroblock in a video frame divided into fixed-sized, rectangular macroblocks, and the predicting computing, and assigning steps are repeated for the macroblocks in the video frame.

5. The method of claim 1 wherein the block of pixels corresponds to a macroblock of a video object plane in video frame having two more video object planes, and the video object planes are each divided into fixed-sized, rectangular macroblocks; and

the predicting, computing and assigning steps are repeated for the macroblocks in the video object planes.

6. A computer readable medium having instructions for performing the steps of claim 1.

7. In a video decoder, a method for decoding macroblocks of a predicted video frame comprising:

receiving a single variable length code representing joint x and y components of a motion vector for each of the macroblocks;

for each of the macroblocks, searching for a single entry in an entropy codebook corresponding to the variable length code and including the x and y components of the motion vector; and

using the x and y components of the motion vector from the codebook to define motion of pixels in a corresponding macroblock.

8. The method of claim 7 wherein the x and y components of the motion vector in the codebook comprise x and y differential motion vector components, and the method comprises:

reconstructing the motion vector from the differential motion vector components and x and y components of a predictor motion vector.

9. The method of claim 7 wherein the codebook is a Huffman table trained for a target bit rate and content type from a statistical analysis of example video sequences having the content type.

SUB A3

10. A computer readable medium having instructions for performing the steps of claim 7.

11. A motion vector encoder comprising:

a motion vector predictor for computing a motion vector predictor for a motion vector of a block of pixels from at least one motion vector for a neighboring block of pixels;

a subtractor for computing differential motion vector components from motion vector components of the predictor and the motion vector of the block of pixels; and

a joint entropy coder for jointly coding the differential motion vector components with a single variable length code.

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12. The encoder of claim 11 wherein the joint entropy coder computes the single variable length code by searching for the code in a Huffman coding table comprising a list of joint differential motion vectors and a corresponding variable length code for each of the joint differential motion vectors.

SUB A4

13. A motion vector decoder comprising:

a motion vector predictor for computing a motion vector predictor for a motion vector of a block of pixels from at least one motion vector for a neighboring block of pixels;

a joint entropy decoder for decoding a single variable length code into joint differential motion vector components; and

an adder for reconstructing X and Y motion vector components from the joint differential motion vector components and X and Y components of the motion vector predictor.

14. The decoder of claim 13 wherein the joint entropy decoder decodes the single variable length code by searching for the code in a Huffman coding table

comprising a list of variable length codes and corresponding joint differential motion vector components for each the variable length codes.

13. The decoder of claim 12 wherein the joint entropy decoder is operable to detect an escape code indicating that two fixed length codes representing X and Y differential motion vector components follow the escape code.

16. In a video coder for coding video images in a block format, a method for improving compression of the video images comprising:

computing x and y motion vector components for a block;

forming the x and y motion vector components into a joint parameter representing joint x and y motion vector components; and

assigning a single variable length code to the joint x and y motion vector components, such that shorter variable length codes are assigned to joint motion vector components that have a higher probability of occurrence in the video images, and longer variable length codes are assigned to joint differential motion vector components that have a lower probability of occurrence.

17. The method of claim 14 further including spatially predicting the x and y motion vector components from a neighboring block of the block; and using spatially predicted components as the joint x and y motion vector components.

18. The method of claim 15 wherein the spatially predicted components are differential motion vector components computed as a difference between x and y components of the motion vector for the block and x and y components of a predictor motion vector.

19. In a video decoder, a method for decoding macroblocks of a predicted video frame comprising:

receiving a single variable length code representing joint differential x and y components of a motion vector for each of the macroblocks;

for each of the macroblocks, searching for a single entry in a Huffman table corresponding to the variable length code and including the joint differential x and y components of the motion vector;

computing x and y components of a predictor motion vector from neighboring macroblocks to the macroblock currently being decoded; and

reconstructing the motion vector from the differential components obtained from the Huffman table and the x and y components of the predictor motion vector.

Add B4